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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OFFICE OF PREVENTION, PESTICIDES AND TOXIC SUBSTANCES

MEMORANDUM

Date: May 27, 2009

SUBJECT: Oxamyl: Revised Occupational and Residential Exposure Assessment

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Decision No.: 372048
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Risk Assessment Type: Single Chemical
TXR No.: NA
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Regulatory Action: Section 3
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TO: Thomas Harris, Product Manager
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The registrant, E.I. du Pont de Nemours and Company has requested a new end use on sugarbeets for the insecticide/nematicide oxamyl. Based on new oxamyl toxicological data, the Health Effects Division (HED) has reassessed all uses of oxamyl as well as the new requested sugarbeet use. This memorandum only addresses risk from occupational exposure as there are currently no residential uses for oxamyl.

Read in RRE 6/1/09 BT

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1.0 EXECUTIVE SUMMARY

Oxamyl, [Methyl N', N'-dimethyl-N-[(methylcarbamoyl)oxy]-1-thio-oxamimidate], is an insecticide/nematicide that is formulated as a soluble concentrate liquid (24% and 42% active ingredient) and as a solid/technical (42% active ingredient). Oxamyl is applied with the following equipment: aerial equipment, chemigation, groundboom sprayer, airblast sprayer, spotgun (low-pressure handwand) applicator, handgun sprayer, and shank soil injection. Application rates for oxamyl range from 0.25 to 4 lb ai/acre.

Oxamyl is a restricted use pesticide. At this time, products containing oxamyl are intended for occupational use only. HED has determined that there are potential exposures to mixers, loaders, applicators, and other handlers during usual use-patterns associated with oxamyl. Based on the use patterns, several major exposure scenarios were identified.

HED's levels of concern for occupational handlers and postapplication workers are 100 for dermal risk and 30 inhalation risk. A common toxicological endpoint does not exist for the dermal and inhalation routes. Therefore, the Margins of Exposure (MOEs) for dermal and inhalation cannot be combined for an aggregate occupational assessment. No chronic scenarios were identified. The short- and intermediate-term dermal risks are identical since the same endpoint was chosen for short- and intermediate-term dermal assessments. The short- and intermediate-term inhalation risks are also identical since the same endpoint was chosen for short- and intermediate-term inhalation assessments.

Calculations of handler dermal risk indicate that the risks do not exceed HED's level of concern (i.e., MOE = 100) at some level of risk mitigation for all of the short- and intermediate-term occupational handler exposure scenarios. Calculations of handler inhalation risk indicate that the risks do not exceed HED's level of concern (i.e., MOE = 30) at baseline (no respirator) for all, except one, of the short- and intermediate-term occupational handler exposure scenarios. For mixing/loading to support aerial applications to cotton in California and Arizona at the 1.0 lb ai/day application rate, a quarter-face, dust/mist filtering respirator with a protection factor of 5 is needed to mitigate short- and intermediate-term inhalation risks.

HED has determined that there are potential exposures to occupational postapplication workers during usual use-patterns associated with oxamyl. Three dislodgeable foliar residue (DFR) studies were submitted in support of the reregistration of oxamyl. The DFR studies were done on three crops: cucumbers, tomatoes, and citrus fruits. To represent an arid and a non-arid climate, two sites were chosen for each crop -- one in California and another one in Florida or Georgia. A soil residue dissipation study also was conducted at the California site under tomato plants. The results of the postapplication risk assessment indicate that for many crops, risks remain a concern for several days following application.

This risk assessment relies in part on data from studies in which adult human subjects were intentionally exposed to a pesticide or other chemical. These studies, which comprise the Pesticide Handlers Exposure Database (PHED), the Outdoor Residential Exposures Task Force

(ORETF), and the Agricultural Reentry Task Force (ARTF) have been determined to require a review of their ethical conduct and have received that review.

2.0 HAZARD CHARACTERIZATION

2.1 Acute Toxicology Categories

Table 1 presents the acute toxicity categories for oxamyl.

Table 1: Acute Toxicity Categories of Oxamyl

Study Type	Toxicity Category (technical)
Acute Oral Toxicity	I
Acute Dermal Toxicity	IV
Acute Inhalation Toxicity	II
Primary Eye Irritation	III
Primary Dermal Irritation	IV
Dermal Sensitization	Not a skin sensitizer

2.2 Toxicological Endpoints of Concern

Oxamyl: Updated Endpoint Selection for Single Chemical Risk Assessment, dated April 29, 2009, indicates that there are toxicological endpoints of concern for oxamyl. Dermal and inhalation points of departure have been identified for short-term (1 to 7 days) and intermediate-term (one week to several months) exposures. These endpoints are listed in Table 2.

Table 2. Summary of Toxicological Dose and Endpoints for Oxamyl for Use in Human Health Risk Assessment				
Exposure Scenario	**Point of Departure (mg/kg/day)**	**Uncertainty/ FQPA Safety Factors**	**RfD, PAD, LOC for Risk Assessment**	**Study and Toxicological Effects**
Acute Dietary *All populations*	0.069 mg/kg	UF_A=1x UF_H=10x FQPA SF=3.48x (brain)	aRfD=0.0069 aPAD= 0.0020 (½ -life for adults and children 2.5 hours)	Human Study (MRID 44912301) BMD_{10}= 0.083 mg/kg $BMDL_{10}$= 0.069 mg/kg, based on RBC AChE inhibition
Chronic Dietary	Due to the rapid recovery of ChE activity, the acute exposure from oxamyl is the main duration of concern and therefore a chronic assessment is not appropriate for oxamyl.			
Incidental Oral (All durations)	Based on the current oxamyl uses, an incidental oral endpoint is not required.			
Dermal	17.05 mg/kg (brain)	UF_A=10x UF_H=10x FQPA SF=1x (infants/children)	MOE = 100 (adult)	21-day dermal rabbit studies (40827601, 44751201) Brain BMD_{10} is 34.91 mg/kg Brain $BMDL_{10}$ is 17.05 mg/kg
Dermal Long-Term (>6 mos)	Due to the rapid recovery of ChE activity, the acute exposure from oxamyl is the main duration of concern and therefore a long-term assessment is not appropriate for oxamyl.			
Inhalation	**RBC Occupational:** HEC = 2.25 mg/m^3 or 0.39 mg/kg **RBC Non-Occupational:** HEC= 0.75 mg/m^3 or 0.13 mg/kg	UF_A=3x UF_H=10x FQPA SF= 1x	MOE = 30 (adult, occupational)	Acute inhalation rat (45155801) RBC BMD_{10}= 0.002 mg/L RBC $BMDL_{10}$= 0.0018 mg/L, based on RBC AChE inhibition in both sexes.
Inhalation Long-Term (>6 mos)	Due to the rapid recovery of ChE activity, the acute exposure from oxamyl is the main duration of concern and therefore a long-term assessment is not appropriate for oxamyl.			
Cancer (oral, dermal, inhalation)	Determined to be "not likely" a human carcinogen (Memorandum: HIARC report, Geruva Reddy, 8/31/1999)			

[1] **Explanation of Abbreviations:** UF = uncertainty factor. UF_A = extrapolation from animal to human (interspecies). UF_H = potential variation in sensitivity among members of the human population (intraspecies). FQPA SF = FQPA Safety Factor. aPAD = population adjusted dose. RfD = reference dose. MOE = margin of exposure. LOC = level of concern. N/A = not applicable. HEC = Human Equivalent Concentration. RDDR = regional deposited dose ratio.

Cancer Determination

Oxamyl was determined to be "not likely" a human carcinogen (Memorandum: HIARC report, Geruva Reddy, 8/31/1999).

FQPA Safety Factor

The FQPA factor of 3.48x is appropriate for infant's/children's subpopulations when relying on adult rat data, depending on the AChE compartment. The FQPA factor is not appropriate for pregnant females since the developmental studies did not indicate susceptibility. Therefore, for the single chemical risk assessment for oxamyl, the FQPA factor may be applied to the oral, dermal, and inhalation assessments for those scenarios only involving children.

Levels of Concern

The levels of concern for occupational handlers and postapplication workers are 100 for dermal risk and 30 for inhalation risk.

Combined Risks

A common toxicological endpoint does not exist for the dermal and inhalation routes. Therefore, the Margins of Exposure (MOEs) for dermal and inhalation cannot be combined for an aggregate occupational assessment.

3.0 PROPOSED USE PATTERNS

3.1 Occupational-Use Products

Oxamyl [Methyl N', N'-dimethyl-N-[(methylcarbamoyl)oxy]-1-thio-oxamimidate] is an insecticide/nematicide that is registered for use on terrestrial food crops and terrestrial food and feed crops.

3.2 Type of Pesticide/Targeted Pest

Oxamyl is an insecticide and nematicide used only in commercial settings and includes (but, is not limited to) the following:

- **Insects**: Pear Rust Mite, Citrus Rust Mite, European Rust Mite, McDaniel Spider Mite, Two spotted Spider Mite, Leafminer, Western Flower Thrips, Citrus Thrips, Onion Thrips, Flea Beetles, Colorado Potato Beetle, Pepper Weevil, Boll Weevil, Banana Root Borer, Carrot Weevil, Seperpentine Leafminer Complex, Vegetable Leafminer, Lygus Bugs, Tarnished Plant Bug, Cotton Fleahopper, Whiteflies, Cotton Aphid, Apple Aphid, Rosy Apple Aphid, Green Peach Aphid, Potato Leafhopper, White Apple Leafhopper, Pink Bollworm, Spotted Tentiform Leafminer, and Cotton Leaf Perforator;

- **Nematodes**: Stubby-root Nematode, Mint Nematode, Sting Nematode, Ring Nematode, Spiral Nematode, Lance Nematode, Reniform Nematode, Pin Nematode, Lesion Nematode, Root-Lesion Nematode, Burrowing Nematode, Bulb Nematode, Stem Nematode, Stunt Nematode, Citrus Nematode, Root-Knot Nematode, and Cyst Nematode;

- **Plant Regulator (Fruit Thinning)**

3.3 Formulation Types and Percent Active Ingredient

Oxamyl is formulated as a soluble concentrate/liquid (24% and 42% active ingredient) and as a solid/technical (42% active ingredient).

3.4 Registered Use Sites

Table 3 lists the occupational use sites, the maximum application rates, and the application equipment for each of the registered uses of oxamyl. Current oxamyl labels state that oxamyl can only be used on commercial and farm plantings. Oxamyl is applied with the following equipment: aerial equipment, chemigation, groundboom sprayer, airblast sprayer, spotgun (low-pressure handwand) applicator, handgun sprayer, and shank soil injection. Application rates for oxamyl range from 0.25 to 4 lb ai/acre. Oxamyl can be applied anywhere from 1 to 12 times a year depending on the crop. Most crops have a maximum seasonal application rate of 6 times or less. Current end-use product labels limit aerial applications to a maximum of 1 pound active ingredient per acre and ground applications to foliage are limited to 2 pounds active ingredient per acre. Soil-directed applications are a maximum of 4 pounds active ingredient per acre. Maximum application rates vary by crop, by method of application, by target of application (soil versus foliage) and by state or region.

There are no registered uses of oxamyl at residential sites. Oxamyl is a restricted use pesticide. At this time, products containing oxamyl are intended for occupational use only. Current oxamyl labels state that oxamyl can only be used in commercial and farm plantings. Oxamyl is not for use in home plantings, nor on any commercial crop that is turned into a "u-pick" or "pick your own" or similar operation.

Table 3: Occupational Uses of Oxamyl

Crop	Geographic Location	Target	Application Equipment	Maximum Application Rate (lb ai/A)
Apples	Entire U.S.	Foliage	airblast, handgun, chemigation	2
	WA	Foliage	aerial	1
	Thinning - NJ, PA, VA, WV	Foliage	airblast, handgun, chemigation	1
Bananas, Plantains	Puerto Rico	Foliage	low pressure handwand	0.005 lb ai/plant
		Soil	low pressure handwand	
Carrot	U.S., except CA	Foliage	groundboom, chemigation	1
		Soil	groundboom	4
			chemigation	2
Celery	AZ, CA	Foliage	aerial	0.5
		Foliage	groundboom, chemigation	0.5
	FL	Foliage	aerial	0.5
		Foliage	groundboom, chemigation	2
		Soil	groundboom	4
	PA, OH, MI, TX	Foliage	groundboom, chemigation	2
		Soil	groundboom	4
Citrus	Entire U.S.	Foliage	aerial, airblast, handgun	1
		Foliage	chemigation	2
		Soil		
Clover Grown for Seed	CA SLN (CA060028)	Foliage	Aerial, groundboom	1
Cotton	AZ and CA	Foliage	aerial, groundboom, chemigation,	1
	U.S., except AZ and CA	Foliage	aerial, groundboom, chemigation,	0.5
Cucurbits: Cucumber, Cantaloupe, Honeydew Melon, Watermelon, Squash, Pumpkin	West of Rockies	Foliage	groundboom, chemigation	1
	East of Rockies	Foliage	aerial, groundboom, chemigation	1
		Soil	groundboom	4
Eggplant	Entire U.S.	Foliage	groundboom, chemigation	1
	U.S., except CA	Soil	groundboom, chemigation	2
Garlic	OR, & NY SLN (NY990002)	Foliage	groundboom, chemigation	2
		Foliage	aerial	1
		Soil	groundboom	4
	CA (Modoc & Siskiyou counties)	Foliage	aerial, groundboom, chemigation	1
	WA SLN (WA000018)	Foliage & Soil	groundboom, chemigation	1
	CA	Foliage	groundboom, chemigation	2
		Soil		
Ginger Root	HI	Foliage	groundboom	1
		Soil	groundboom	4

Table 3: Occupational Uses of Oxamyl				
Crop	**Geographic Location**	**Target**	**Application Equipment**	**Maximum Application Rate (lb ai/A)**
Nonbearing Fruit (apple, cherry, citrus, peach, pear)	Entire U.S.	Foliage	aerial, groundboom, airblast, handgun, chemigation	1
		Soil	groundboom, airblast, handgun	4
Onions (dry bulb only)	OR, ID, WA, & NY SLN (NY990002)	Foliage	aerial	1
		Foliage	groundboom, chemigation	2
		Soil	groundboom	4
	CA	Soil	groundboom	2
		Foliage	groundboom, chemigation	2
	CA (Modoc & Siskiyou counties) & CO SLN (CO010005) & NV SLN (NY990002) & UT SLN (UT990004)	Foliage	aerial, groundboom, chemigation	1
	MI, TX	Foliage	aerial	0.5
		Foliage	groundboom, chemigation	2
		Soil	groundboom	4
	WI SLN (WI070005)	Foliage	aerial, groundboom	0.5
		Soil	Groundboom	4
	NM	Foliage	aerial, groundboom, chemigation	0.5
Peanuts	U.S., except CA	Foliage	aerial, groundboom, chemigation	0.5
		Soil	aerial, groundboom, chemigation	0.5
Pears	U.S., except CA	Foliage	airblast, handgun, chemigation	2
Peppermint and Spearmint	ID, MI, MT, OR, WA, WI	Foliage	groundboom, chemigation	2
			aerial	1
Peppers (Bell and Non-Bell)	Entire U.S.	Foliage	aerial, groundboom, chemigation	1
		Soil	groundboom, chemigation	1
Pineapple	U.S., except CA	Foliage	groundboom, chemigation	2
		Soil	groundboom, chemigation	2

Table 3: Occupational Uses of Oxamyl				
Crop	**Geographic Location**	**Target**	**Application Equipment**	**Maximum Application Rate (lb ai/A)**
Potatoes	Entire U.S.	Foliage	aerial, groundboom, chemigation	1
	MD SLN (MD080003) & NY SLN (NY080001)	Foliage & Soil	groundboom, chemigation	2
	PA SLN (PA070002)	Foliage	groundboom, chemigation	1
		Soil	groundboom	2
	U.S., except Northeast, Mid-Atlantic States	Soil	groundboom	4
Sugar Beet	Entire U.S.	Foliage	groundboom	1
		Soil	groundboom	2
Sweet Potatoes	U.S., except CA	Soil	groundboom	4
Tobacco	Entire U.S.	Soil	groundboom, chemigation	2
Tomatoes	Entire U.S.	Foliage	aerial, groundboom, chemigation	1
		Soil	chemigation	2
	CA only	Soil	groundboom	1.25
Yams	Puerto Rico	Soil	groundboom, chemigation	0.5

4.0 OCCUPATIONAL EXPOSURE/RISK PATHWAY

4.1 Handler Exposures

HED has determined that there are potential exposures to mixers, loaders, applicators, and other handlers during usual use patterns associated with oxamyl. Based on the use patterns of oxamyl, several major exposure scenarios were identified for oxamyl: (1a) mixing/loading liquids for aerial application; (1b) mixing/loading liquids for chemigation application; (1c) mixing/loading liquids for groundboom application; (1d) mixing/loading liquids for airblast application; (2) applying liquids with aerial equipment; (3) applying liquids with a groundboom sprayer; (4) applying liquids with an airblast sprayer; (5) flagging for liquid aerial applications; (6) mixing/loading/applying with spotgun (low-pressure handwand) equipment; and (7) mixing/loading/applying with handgun equipment.

4.1.1 Handler Assumptions

Chemical-specific data for assessing human exposures during pesticide handling activities were not submitted to the Agency in support of the reregistration of oxamyl. It is the policy of the HED to use data from the Pesticide Handlers Exposure Database (PHED) Version 1.1 and data from the Outdoor Residential Exposure Task Force (ORETF) to assess handler exposures for regulatory actions when chemical-specific monitoring data are not available.

PHED: The PHED Task Force is comprised of representatives from the U.S. EPA, Health Canada, the California Department of Pesticide regulation, and member companies of the American Crop Protection Association. PHED is a software system consisting of two parts: a database of measured exposure values for workers involved in the handling of pesticides under actual field conditions and a set of computer algorithms used to subset and statistically summarize the selected data. Currently, the database contains values for over 1,700 monitored individuals (i.e., replicates).

Users select criteria to subset the PHED database to reflect the exposure scenario being evaluated. The subsetting algorithms in PHED are based on the central assumption that the magnitude of handler exposures to pesticides are primarily a function of activity (e.g., mixing/loading, applying), formulation type (e.g., wettable powders, granulars), application method (e.g., aerial, groundboom), and clothing scenarios (e.g., gloves, double layer clothing).

Once the data for a given exposure scenario have been selected, the data are normalized (i.e., divided by) by the amount of pesticide handled resulting in standard unit exposures (milligrams of exposure per pound of active ingredient handled). Following normalization, the data are statistically summarized. The distribution of exposure values for each body part (e.g., chest upper arm) is categorized as normal, lognormal, or "other" (i.e., neither normal nor lognormal). A central tendency value is then selected from the distribution of the exposure values for each body part. These values are the arithmetic mean for normal distributions, the geometric mean for lognormal distributions, and the median for all "other" distributions. Once

selected, the central tendency values for each body part are composited into a "best fit" exposure value representing the entire body.

The unit exposure values calculated by PHED generally range from the geometric mean to the median of the selected data set. While data from PHED provide the best available information on handler exposures, it should be noted that some aspects of the included studies (e.g., duration, acres treated, pounds of active ingredient handled) may not accurately represent labeled uses in all cases. HED has developed a series of tables of standard unit exposure values for many occupational scenarios that can be utilized to ensure consistency in exposure assessments (PHED Surrogate Exposure Guide, August 1998).

ORETF Handler Studies (MRID 449722-01): A report was submitted by the ORETF (Outdoor Residential Exposure Task Force) that presented data in which the application of various products used on turf by homeowners and lawncare operators (LCOs) was monitored. All of the data submitted in this report were completed in a series of studies.

OMA002: *LCO Liquid Applications with a Low Pressure Handgun* (MRID 449722-01): A mixer/loader/applicator study was performed by the Outdoor Residential Exposure Task Force (ORETF) using Dacthal as a surrogate compound to determine "generic" exposures to individuals applying a pesticide to turf with a low-pressure "nozzle gun" or "handgun" sprayer. Dermal and inhalation exposures were estimated using whole-body passive dosimeters and breathing-zone air samples on OVS tubes. Inhalation exposure was calculated using an assumed respiratory rate of 17 liters per minute for light work (NAFTA, 1999), the actual sampling time for each individual, and the pump flow rate. All results were normalized for pounds active ingredient handled.

A total of 90 replicates were monitored using 17 different subjects. Four different formulations of dacthal [75% wettable powder (packaged in 4 and 24 pound bags), 75% wettable powder in water soluble bags (3 pound bag), 75% water dispersible granules (2 pound bag) and 55% liquid flowable (2.5 gallon container)] were applied by five different LCOs to actual residential lawns at each site in three different locations (Ohio, Maryland, and Georgia) for a total of fifteen replicates per formulation. An additional ten replicates at each site were monitored while they performed spray application only using the 75 percent wettable powder formulation. A target application rate of 2 pounds active ingredient was used for all replicates (actual rate achieved was about 2.2 pounds active ingredient per acre). Each replicate treated a varying number of actual client lawns to attain a representative target of 2.5 acres (1 hectare) of turf. The exposure periods averaged five hours twenty-one minutes, five hours thirty-nine minutes, and six hours twenty-four minutes, in Ohio, Maryland and Georgia, respectively. Average time spent spraying at all sites was about two hours. All mixing, loading, application, adjusting, calibrating, and spill clean up procedures were monitored, except for typical end-of-day clean-up activities, e.g. rinsing of spray tank, etc. Dermal exposure was measured using inner and outer whole body dosimeters, hand washes, face/neck washes, and personal air monitoring devices. All test subjects wore one-piece, 100 percent cotton inner dosimeters beneath 100 percent cotton long-sleeved shirt and long pants, rubber boots and nitrile gloves.

Gloves are typically worn by most LCOs, and required by many pesticide labels for mixing and loading.

Overall, residues were highest on the upper and lower leg portions of the dosimeters. In general, concurrent lab spikes produced mean recoveries in the range of 78-120 percent, with the exception of OVS sorbent tube sections which produced mean recoveries as low as 65.8 percent. Adjustment for recoveries from field fortifications were performed on each dosimeter section or sample matrix for each study participant, using the mean recovery for the closest field spike level for each matrix and correcting the value to 100 percent. The unit exposure values are presented below in Table 4. [Note the data were found to be lognormally distributed. As a result, all exposure values are geometric means.]

Table 4: Unit Exposure Values Obtained for LCO Liquid Applications with a Low Pressure Handgun from ORETF Handgun Studies (MRID 449722-01)

Application Method[4]	Total Dermal Unit Exposure[1] (mg/lb ai)			Inhalation Unit Exposure[1,2] (µg/lb ai)
	Single Layer, No Gloves	Single Layer, Gloves	Double Layer[3], Gloves	
LCO Handgun Spray Mixer/Loader/Applicator Liquid Flowable	No Data	0.45	0.245	1.8

[1] Unit exposure values reported are geometric means.
[2] Air concentration (mg/m^3/lb ai) calculated using NAFTA '99 standard breathing rate of 17 lpm (1 m^3/hr).
[3] Exposure calculated using OPP/HED 50% protection factor (PF) for cotton coveralls on torso, arms, and legs.
[4] All commercial handlers wore long pants, long-sleeved shirt, nitrile gloves and shoes.

ORETF Handler Studies (MRID 444598-01): A report was submitted by the ORETF (Outdoor Residential Exposure Task Force) that presented data in which the application of various products used on vegetable gardens by homeowners was monitored. All of the data submitted in this report were completed in a series of studies.

OMA006: Homeowner Liquid Application to Garden with a Low Pressure Handwand (MRID 444598-01): The study was designed to quantify dermal and inhalation exposure of homeowners as they mixed, loaded and applied liquid formulations of a carbaryl end-use product to home garden vegetables. A low pressure handwand) was used to apply Sevin Liquid® Brand Carbaryl Insecticide. Twenty replicates were conducted with gloves and 20 replicates were conducted without gloves. Inhalation exposure was monitored using personal air samplers (average flow rate of 1.5 liter/minute) and dermal exposure was monitored by using inner and outer dosimeters, facial/neck wipes, and hand washes. The overall mean field fortification recovery of each matrix ranged from 77.6 ± 13.6% (outer dosimeters) to 98.4 ± 3.8% (OVS tubes). Laboratory fortified recovery samples were analyzed with each set of samples analyzed on a particular day; however, the results of the laboratory recoveries were not provided in the Study Report. Unit exposures were calculated for short pants/short sleeves, long pants/short sleeves, and long pants/long sleeves scenarios. The results for the low pressure handwand are summarized in Table 5 below.

Table 5. Unit Exposure Values for Homeowner Liquid Application to Garden with a Low Pressure Handwand Obtained From ORETF Study (MRID 444598-01)			
Scenario Monitored	Total Dermal Unit Exposure[1] (mg/lb ai)		Inhalation Unit Exposure[1] (µg/lb ai)
	Gloves	No Gloves	No Respirator
Homeowner Liquid Applications with a Low Pressure Handwand Sprayer	0.33	15	2.7

[1] Unit exposure values reported are geometric means.

The following general assumptions are made:

- Average body weight of an adult handler is 70 kg.
- Average work day interval is 8 hours which represents a typical day.
- Calculations of handler scenarios are completed using the maximum application rates on the oxamyl labels.
- PHED Version 1.1 or ORETF surrogate data were used for to estimate exposures for all scenarios. NOTE: According to information provided by DuPont, the Vydate L spotgun applicator appears to have a similar application technique as a low pressure handwand and therefore exposure from the spotgun is assumed to be similar to the low pressure handwand. Thus, PHED and ORETF unit exposure data from the use of a low pressure handwand was used as surrogate data for the spotgun applicator.
- Due to a lack of scenario-specific data, HED calculated unit exposure values using generic data from the Pesticide Handler Exposure Database (PHED) and the Outdoor Residential Exposure Task Force database (ORETF). When necessary, protection factors are applied to represent various risk mitigation options (i.e., the use of respirator and double-layer body protection).
- Exposures were estimated for handlers using:
  - 1200 acres per day for aerial applications to cotton,
  - 350 acres per day for aerial applications to all other crops,
  - 350 acres per day for chemigation applications,
  - 200 acres per day for groundboom applications to cotton,
  - 80 acres per day for groundboom applications to all other crops,
  - 40 acres per day for airblast applications to tree crops,
  - 5 acres per day for handgun applications to tree crops, and
  - 2 acres per day for a spotgun (low-pressure handwand applications to bananas and plantains. Note: According to information provided by DuPont, there are

approximately 715 banana plants per acre and a person can apply oxamyl with a spotgun to approximately 2 acres per day. Since 10 mL of concentrate is applied per plant, then 3.6 pounds active ingredient is applied per acre.

- There are no data to assess handler exposure during a shank injection application. However, exposure to handlers during groundboom application is considered to be a reasonable surrogate.

4.1.2 Handler Equations

Potential daily dermal exposure is calculated using the following formula:

$$Daily\ Dermal\ Exposure\left(\frac{mg\ ai}{day}\right) = Unit\ Exposure\left(\frac{mg\ ai}{lb\ ai}\right) x\ Use\ Rate\left(\frac{lb\ ai}{A}\right) x\ Daily\ Acres\ Treated\left(\frac{A}{day}\right)$$

Potential daily inhalation exposure is calculated using the following formula:

$$Daily\ Inhalation\ Exposure\left(\frac{mg\ ai}{day}\right) =$$

$$Unit\ Exposure\left(\frac{\mu g\ ai}{lb\ ai}\right) x\ Conversion\ Factor\left(\frac{1mg}{1{,}000\ \mu g}\right) x\ Use\ Rate\left(\frac{lb\ ai}{A}\right) x\ Daily\ Acres\ Treated\left(\frac{A}{day}\right)$$

The daily dermal and inhalation dose is calculated using a 70 kg body weight for both short-term and intermediate-term exposure as follows:

$$Daily\ Dermal\ Dose\left(\frac{mg\ ai}{Kg/Day}\right) = Daily\ Dermal\ Exposure\left(\frac{mg\ ai}{Day}\right) x\left(\frac{1}{Body\ Weight\ (Kg)}\right)$$

$$Daily\ Inhalation\ Dose\left(\frac{mg\ ai}{kg/day}\right) = Daily\ Inhalation\ Exposure\left(\frac{mg\ ai}{day}\right) x\left(\frac{1}{Body\ Weight\ (kg)}\right)$$

The short-term and intermediate-term risks for dermal exposure were calculated using a NOAEL of 17.05 mg/kg/day. The short-term and intermediate-term risks for inhalation exposure were calculated using a NOAEL of 0.39 mg/kg/day. The inhalation and dermal MOEs were calculated using the following formulas:

$$Dermal\ MOE = \frac{NOAEL\left(\frac{mg}{kg/day}\right)}{Dermal\ Daily\ Dose\left(\frac{mg}{kg/day}\right)}$$

$$Inhalation\ MOE = \frac{NOAEL\left(\frac{mg}{kg/day}\right)}{Inhalation\ Daily\ Dose\left(\frac{mg}{kg/day}\right)}$$

A common toxicological endpoint does not exist for the dermal and inhalation routes. Therefore, the Margins of Exposure (MOEs) for dermal and inhalation cannot be combined for an aggregate occupational assessment.

4.1.3 Summary of Risk Concerns for Occupational Handlers

Short-term and intermediate-term risks at baseline attire – long-sleeved shirt, long pants, shoes, socks, and no respirator – (developed using PHED Version 1.1 and ORETF surrogate data) are presented in Table 6. The short- and intermediate-term risks with baseline attire plus personal protective equipment and with engineering controls are presented in Table 7. HED's levels of concern for occupational workers are 100 for dermal risks and 30 for inhalation risks. A common toxicological endpoint does not exist for the dermal and inhalation routes. Therefore, the Margins of Exposure (MOEs) for dermal and inhalation cannot be combined for an aggregate occupational assessment. The short- and intermediate-term dermal risks are identical since the same endpoint was chosen for short- and intermediate-term dermal assessments. The short- and intermediate-term inhalation risks are also identical since the same endpoint was chosen for short- and intermediate-term inhalation assessments.

4.1.3.1 Dermal Risks

The short- and intermediate-term dermal risks did not exceed HED's level of concern with **baseline** attire for the following scenarios:

- Applying sprays with a groundboom sprayer on all crops and all application rates, and
- Flagging to support aerial spray operations on all crops and all application rates.

The short- and intermediate-term MOEs did not exceed HED's level of concern with the addition of **chemical-resistant gloves** to baseline attire for the following scenarios:

- Mixing/loading liquid concentrates to support aerial and chemigation applications at the 0.5 lb ai/A and 1.0 lb ai/A application rate and 350 acres per day,
- Mixing/loading liquid concentrates for groundboom applications,
- Mixing/loading liquid concentrates for airblast applications,
- Applying sprays via airblast equipment at the 1.0 lb ai/A application rate,

- Mixing/loading/applying liquid concentrates with low pressure handwand, and
- Mixing/loading/applying liquid concentrates with a handgun sprayer

The short- and intermediate-term MOEs did not exceed HED's level of concern with the addition of **double layer body attire** and **chemical-resistant gloves** for the following scenarios:

- Mixing/loading liquid concentrates to support aerial applications to cotton at the 0.5 lb ai/A application rate and 1200 acres per day,
- Mixing/loading liquid concentrates to support chemigation applications at the 2.0 lb ai/A application rate and 350 acres per day, and
- Applying sprays via airblast equipment at the 2.0 lb ai/A application rate.

The short- and intermediate-term MOEs did not exceed HED's level of concern with **engineering controls** for:

- Closed system mixing/loading liquid concentrates to support aerial applications to cotton in California and Arizona at the 1.0 lb ai/A application rate and 1200 acres per day, and
- Applying sprays with aircraft with enclosed cockpit and baseline attire-- the only data available is for engineering controls (i.e., an enclosed cockpit).

4.1.3.2 Inhalation Risks

The short- and intermediate-term inhalation risks did not exceed HED's level of concern at the **baseline** level (no respirator) for all handler scenarios, *except* mixing/loading to support aerial applications to cotton in California and Arizona at the 1.0 lb ai/day application rate. For mixing/loading to support aerial applications to cotton in California and Arizona at the 1.0 lb ai/day application rate, a quarter-face, dust/mist filtering respirator with a protection factor of 5 is needed to mitigate short- and intermediate-term inhalation risks. Note that only the only data available for applying sprays with aircraft is for engineering controls (i.e., an enclosed cockpit) – the risks did not exceed HED's level of concern for aerial applicators at baseline attire as long as enclosed cockpits are used.

Table 6. Occupational Short-Term and Intermediate-Term Dermal and Inhalation Oxamyl Doses and Risks at Baseline.									
Exposure Scenario	Crop or Target	Application Rate[a] (lb ai/A)	Area Treated Daily[b] (acres)	Unit Exposure[c, d]		Dermal Dose		MOEs	
				Dermal (mg/lb ai)	Inhalation (µg/lb ai)	Dermal[e] (mg/kg/day)	Inhalation[f] (mg/kg/day)	Dermal[g] (LOC = 100)	Inhalation[h] (LOC = 30)
Mixer/Loader									
Mixing/Loading Liquid Concentrates for Aerial Applications (PHED)	Apples (WA only); Citrus; Clover Grown for Seed (SLN CA), Cucurbits (East of Rockies), Garlic (OR & CA - Modoc & Siskiyou counties, SLN NY); Nonbearing Fruit (apple, cherry, citrus, peach, pear); Dry Bulb Onions (CA - Modoc & Siskiyou counties, OR, ID, WA, SLN CO, SLN NV, SLN NY, SLN UT); Peppermint and Spearmint (ID, MI, MT, OR, WA, WI); Peppers; Potatoes (also SLN PA); Tomatoes	1	350	2.9	1.2	15	0.006	1.2	**65**
	Cotton (CA and AZ)	1	1200	2.9	1.2	50	0.021	0.3	19
	Cotton (not AZ and CA)	0.5	1200	2.9	1.2	25	0.01	0.7	**38**
	Celery (AZ, CA, FL); Dry Bulb Onions (MI, NM, TX, SLN WI); Peanuts (not CA)	0.5	350	2.9	1.2	7.3	0.003	2.4	**130**

Table 6. Occupational Short-Term and Intermediate-Term Dermal and Inhalation Oxamyl Doses and Risks at Baseline.									
Exposure Scenario	Crop or Target	Application Rate[a] (lb ai/A)	Area Treated Daily[b] (acres)	Unit Exposure[c, d]		Dermal Dose		MOEs	
				Dermal (mg/lb ai)	Inhalation (µg/lb ai)	Dermal[e] (mg/kg/day)	Inhalation[f] (mg/kg/day)	Dermal[g] (LOC = 100)	Inhalation[h] (LOC = 30)
Mixing/Loading Liquid Concentrates for Chemigation Applications (PHED)	Apples; Carrot (not CA); Celery (FL, PA, OH, MI, TX); Citrus; Eggplant (not CA); Garlic (CA, OR); Dry Bulb Onions (CA, OR, ID, WA. MI, TX); Pears (not CA); Peppermint and Spearmint (ID, MI, MT, OR, WA, WI); Pineapple (not CA); Potatoes (SLN MD, SLN NY, SLN PA); Tobacco; Tomatoes	2	350	2.9	1.2	29	0.012	0.6	**33**
	Apples for Thinning (NJ, PA, VA, WV); Cotton (CA and AZ); Cucurbits; Dry Bulb Onions (SLN CO, SLN NV, SLN UT); Eggplant (CA); Garlic (SLNWA); Nonbearing Fruit (apple, cherry, citrus, peach, pear); Peppers; Potatoes	1	350	2.9	1.2	15	0.006	1.2	**65**
	Celery (AZ, CA); Cotton (not CA and AZ); Dry Bulb Onions (NM); Peanuts (not CA); Yams (Puerto Rico only)	0.5	350	2.9	1.2	7.3	0.003	2.4	**130**
Mixing/Loading Liquids Concentrates for Groundboom Applications (PHED)	Nonbearing Fruit (apple, cherry, citrus, peach, pear; soil); Carrots (not CA); Celery (FL, PA, OH, MI, TX); Cucurbits (East of Rockies); Garlic (OR, SLN NY); Ginger Roots (HI); Dry Bulb Onions (MI, TX, OR, ID, WA, SLN NY, SLN WI); Sweet Potatoes (not in CA); Potatoes (U.S. except Northeast, Mid-Atlantic States)	4 (all soil-directed)	80	2.9	1.2	13	0.0055	1.3	**71**

Table 6. Occupational Short-Term and Intermediate-Term Dermal and Inhalation Oxamyl Doses and Risks at Baseline.									
Exposure Scenario	Crop or Target	Application Rate[a] (lb ai/A)	Area Treated Daily[b] (acres)	Unit Exposure[c, d]		Dermal Dose		MOEs	
				Dermal (mg/lb ai)	Inhalation (µg/lb ai)	Dermal[e] (mg/kg/day)	Inhalation[f] (mg/kg/day)	Dermal[g] (LOC = 100)	Inhalation[h] (LOC = 30)
Mixing/Loading Liquids Concentrates for Groundboom Applications (PHED) cont	Pineapples (not CA); Eggplants (not CA); Garlic (CA); Dry Bulb Onions (CA); Peppermint and Spearmint (ID, MI, MT, OR, WA, WI); Potatoes (SLN MD, SLN NY, SLN PA); Tobacco; Sugar Beets	2	80	2.9	1.2	6.6	0.0027	2.6	**140**
	Tomatoes (CA)	1.25	80	2.9	1.2	4.1	0.0017	4.1	**230**
	Clover Grown for Seed (SLN CA); Cucurbits (West of Rockies); Dry Bulb Onions (SLN CO, SLN NV, SLN UT); Eggplants (CA); Garlic (SLNWA); Peppers; Potatoes (Northeast and Mid-Atlantic States); Tomatoes (entire US)	1	80	2.9	1.2	3.3	0.0014	5.1	**280**
	Cotton (AZ and CA)	1	200	2.9	1.2	8.3	0.0034	2.1	**110**
	Cotton (U.S. except CA and AZ)	0.5	200	2.9	1.2	4.1	0.0017	4.1	**230**
	Celery (AZ, CA); Dry Bulb Onions (NM); Yams (Puerto Rico Only); Peanuts (not in CA)	0.5	80	2.9	1.2	1.7	0.00069	10	**570**

Table 6. Occupational Short-Term and Intermediate-Term Dermal and Inhalation Oxamyl Doses and Risks at Baseline.									
Exposure Scenario	Crop or Target	Application Rate[a] (lb ai/A)	Area Treated Daily[b] (acres)	Unit Exposure[c, d]		Dermal Dose		MOEs	
				Dermal (mg/lb ai)	Inhalation (µg/lb ai)	Dermal[e] (mg/kg/day)	Inhalation[f] (mg/kg/day)	Dermal[g] (LOC = 100)	Inhalation[h] (LOC = 30)
Mixing/Loading Liquids Concentrates for Airblast Applications (PHED)	Apples; Pears (not CA)	2	40	2.9	1.2	3.3	0.0014	5.1	**280**
Mixing/Loading Liquids Concentrates for Airblast Applications (PHED) cont	Apples for Thinning (NJ, PA, VA, WV); Citrus; Nonbearing Fruit (apple, cherry, citrus, peach, pear)	1	40	2.9	1.2	1.7	0.00069	10	**570**
Applicator									
Applying Sprays via Aerial Equipment (PHED)	Apples (WA only); Citrus; Clover Grown for Seed (SLN CA); Cucurbits (East of Rockies), Garlic (OR & CA - Modoc & Siskiyou counties, SLN NY); Nonbearing Fruit (apple, cherry, citrus, peach, pear); Dry Bulb Onions (CA - Modoc & Siskiyou counties, OR, ID, WA, SLN CO, SLN NV, SLN NY, SLN UT); Peppermint and Spearmint (ID, MI, MT, OR, WA, WI); Peppers; Potatoes (also SLN PA); Tomatoes	1	350	No Data	No Data	No Data	No Data	No Data	No Data
	Cotton (CA and AZ)	1	1,200	No Data	No Data	No Data	No Data	No Data	No Data
	Cotton (not AZ and CA)	0.5	1,200	No Data	No Data	No Data	No Data	No Data	No Data
	Celery (AZ, CA, FL); Dry Bulb Onions (MI, NM, TX, SLN WI); Peanuts (not CA)	0.5	350	No Data	No Data	No Data	No Data	No Data	No Data

Table 6. Occupational Short-Term and Intermediate-Term Dermal and Inhalation Oxamyl Doses and Risks at Baseline.									
Exposure Scenario	Crop or Target	Application Rate[a] (lb ai/A)	Area Treated Daily[b] (acres)	Unit Exposure[c, d]		Dermal Dose		MOEs	
				Dermal (mg/lb ai)	Inhalation (µg/lb ai)	Dermal[e] (mg/kg/day)	Inhalation[f] (mg/kg/day)	Dermal[g] (LOC = 100)	Inhalation[h] (LOC = 30)
Applying Sprays via Groundboom Equipment (PHED)	Nonbearing Fruit (apple, cherry, citrus, peach, pear); Carrot (not CA); Celery (FL, PA, OH, MI, TX); Cucurbits (East of Rockies); Garlic (OR, SLN NY); Ginger Root (HI); Dry Bulb Onions (MI, TX, OR, ID, WA, SLN NY, SLN WI); Sweet Potatoes (not in CA); Potatoes (U.S. except Northeast, Mid-Atlantic States)	4 (all soil-directed)	80	0.014	0.74	0.064	0.0034	**270**	**120**
	Pineapple (not CA); Eggplant (not CA); Garlic (CA); Dry Bulb Onions (CA); Peppermint and Spearmint (ID, MI, MT, OR, WA, WI); Potatoes (SLN MD, SLN NY, SLN PA); Tobacco; Sugar Beet	2	80	0.014	0.74	0.032	0.0017	**530**	**230**
	Tomatoes (CA)	1.25	80	0.014	0.74	0.02	0.0011	**850**	**370**
	Clover Grown for Seed (SLN CA); Cucurbits (West of Rockies); Dry Bulb Onions (SLN CO, SLN NV, SLN UT): Eggplant (CA); Garlic (SLNWA); Peppers; Potatoes (Northeast and Mid-Atlantic States); Tomatoes (entire US)	1	80	0.014	0.74	0.016	0.00085	**1,100**	**460**
	Cotton (AZ and CA)	1	200	0.014	0.74	0.04	0.0021	**430**	**180**
	Cotton (U.S. except CA and AZ)	0.5	200	0.014	0.74	0.02	0.0011	**850**	**370**

Table 6. Occupational Short-Term and Intermediate-Term Dermal and Inhalation Oxamyl Doses and Risks at Baseline.									
Exposure Scenario	Crop or Target	Application Rate[a] (lb ai/A)	Area Treated Daily[b] (acres)	Unit Exposure[c, d]		Dermal Dose		MOEs	
				Dermal (mg/lb ai)	Inhalation (µg/lb ai)	Dermal[e] (mg/kg/day)	Inhalation[f] (mg/kg/day)	Dermal[g] (LOC = 100)	Inhalation[h] (LOC = 30)
Applying Sprays via Groundboom Equipment (PHED) cont	Celery (AZ, CA); Dry Bulb Onions (NM); Yams (Puerto Rico Only); Peanuts (not in CA)	0.5	80	0.014	0.74	0.008	0.00042	**2,100**	**920**
Applying Sprays via Airblast Equipment PHED)	Apples; Pears (not CA)	2	40	0.36	4.5	0.41	0.0051	41	**76**
	Apples for Thinning (NJ, PA, VA, WV); Citrus; Nonbearing Fruit (apple, cherry, citrus, peach, pear)	1	40	0.36	4.5	0.21	0.0026	83	**150**
Flagger									
Flagging for Aerial Sprays Applications (PHED)	Apples (WA only); Citrus; Clover Grown for Seed (SLN CA); Cucurbits (East of Rockies), Garlic (OR & CA - Modoc & Siskiyou counties, SLN NY); Nonbearing Fruit (apple, cherry, citrus, peach, pear); Dry Bulb Onions (CA - Modoc & Siskiyou counties, OR, ID, WA, SLN CO, SLN NV, SLN NY, SLN UT); Peppermint and Spearmint (ID, MI, MT, OR, WA, WI); Peppers; Potatoes (also SLN PA); Tomatoes	1	350	0.011	0.35	0.055	0.0018	**310**	**220**
	Cotton (CA and AZ)	1	350	0.011	0.35	0.055	0.0018	**310**	**220**
	Cotton (U.S. except AZ and CA)	0.5	350	0.011	0.35	0.028	0.00088	**620**	**450**
	Celery (AZ, CA, FL); Dry Bulb Onions (MI, NM, TX, SLN WI); Peanuts (not CA)	0.5	350	0.011	0.35	0.028	0.00088	**620**	**450**

Table 6. Occupational Short-Term and Intermediate-Term Dermal and Inhalation Oxamyl Doses and Risks at Baseline.									
Exposure Scenario	Crop or Target	Application Rate[a] (lb ai/A)	Area Treated Daily[b] (acres)	Unit Exposure[c, d]		Dermal Dose		MOEs	
				Dermal (mg/lb ai)	Inhalation (µg/lb ai)	Dermal[e] (mg/kg/day)	Inhalation[f] (mg/kg/day)	Dermal[g] (LOC = 100)	Inhalation[h] (LOC = 30)
Mixer/Loader/Applicator									
Mixing/Loading/Applying Liquid Concentrates with Low Pressure Handwand (PHED)	Bananas, Plantains (PR)	3.6	2	100	30	10	0.0031	1.7	**130**
Mixing/Loading/Applying Liquid Concentrates with Low Pressure Handwand (ORETF, ground directed)	Bananas, Plantains (PR)	3.6	2	15	2.7	1.5	0.00028	11	**1,400**
Mixing/Loading/Applying Liquid Concentrates with a Handgun Sprayer (LCO ORETF data)	Nonbearing Fruit (apple, cherry, citrus, peach, pear)	4	5	No Data	1.8	No Data	0.00051	No Data	**760**
	Apples; Pears (not CA)	2	5	No Data	1.8	No Data	0.00026	No Data	**1,500**
	Apples for Thinning (NJ, PA, VA, WV); Citrus	1	5	No Data	1.8	No Data	0.00013	No Data	**3,000**

Footnotes

a. Application rates are maximum application rates from the labels.

b. Science Advisory Council Policy # 9.1

c. Unit Exposures based on PHED Version 1.1 and ORETF. Baseline dermal unit exposure represents long pants, long sleeved shirt, no gloves, open mixing/loading, open cab tractor. Baseline inhalation exposure represents no respirator.

d. Only engineering control (enclosed cockpit) data are available to assess dermal and inhalation risks to handlers operating aircraft. Only baseline attire (single layer of clothing) plus chemical-resistant glove data are available to assess dermal risks to handlers mixing/loading/applying liquid concentrates with a handgun sprayer.

e. Dermal Dose (mg/kg/day) = daily unit exposure (mg/lb ai) x application rate (lb ai/acre) x acres treated / body weight (70 kg).

f. Inhalation Dose (mg/kg/day) = daily unit exposure (µg/lb ai) x conversion factor (1 mg/1,000 µg) x application rate (lb ai/acre) x acres treated / body weight (70 kg).

g. Dermal MOE = NOAEL (17.05 mg/kg/day) / dermal daily dose (mg/kg/day). Level of concern = 100.

h. Inhalation MOE = NOAEL (0.39 mg/kg/day) / inhalation daily dose (mg/kg/day). Level of concern = 30.

Table 7. Occupational Short-Term and Intermediate-Term Dermal and Inhalation Oxamyl Doses and Risk with Personal Protective Equipment and Engineering Controls.

Exposure Scenario	Crop or Target	Application Rate[a] (lb ai/A)	Area Treated Daily[b] (acres)	Unit Exposure[c, d]		Dermal Dose		MOEs	
				Dermal PPE-G (mg/lb ai)	Inhalation 80% PPE-R (µg/lb ai)	Dermal PPE-G[d] (mg/kg/day)	Inhalation 80% PPE-R respirator[e] (mg/kg/day)	Dermal PPE-G[f] (LOC = 100)	Inhalation 80% PPE-R respirator[g] (LOC = 30)
Mixer/Loader									
Mixing/Loading Liquid Concentrates for Aerial Applications (PHED)	Apples (WA only); Citrus; Clover Grown for Seed (SLN CA); Cucurbits (East of Rockies), Garlic (OR & CA - Modoc & Siskiyou counties, SLN NY); Nonbearing Fruit (apple, cherry, citrus, peach, pear); Dry Bulb Onions (CA - Modoc & Siskiyou counties, OR, ID, WA, SLN CO, SLN NV, SLN NY, SLN UT); Peppermint and Spearmint (ID, MI, MT, OR, WA, WI); Peppers; Potatoes (also SLN-PA); Tomatoes	1	350	0.023	0.24	0.12	0.0012	**150**	**330**
	Cotton (CA and AZ)	1	1200	0.023 (0.017 for PPE-G, DL and 0.0086 for EC)	0.24	0.39 (0.29 for PPE-G, DL and 0.15 for EC)	0.0041	43 (59 for PPE-G, DL & **120 for EC**)	**95**
	Cotton (not AZ and CA)	0.5	1200	0.023 (0.017 for PPE-G, DL)	0.24	0.2 (0.15 for PPE-G, DL)	0.0021	86 (**120 for PPE-G, DL**)	**190**
	Celery (AZ, CA, FL); Dry Bulb Onions (MI, NM, TX, SLN WI); Peanuts (not CA)	0.5	350	0.023	0.24	0.058	0.0006	**300**	**650**
Mixing/Loading Liquid Concentrates for Chemigation Applications (PHED)	Apples; Carrot (not CA); Celery (FL, PA, OH, MI, TX); Citrus; Eggplant (not CA); Garlic (CA, OR); Dry Bulb Onions (CA, OR, ID, WA. MI, TX); Pears (not CA); Peppermint and Spearmint (ID, MI, MT, OR, WA, WI); Pineapple (not CA); Potatoes (SLN MD, SLN NY, SLN PA); Tobacco; Tomatoes	2	350	0.023 (0.017 for PPE-G, DL)	0.24	0.23 (0.17 for PPE-G, DL)	0.0024	74 (**100 for PPE-G, DL**)	**160**

Table 7. Occupational Short-Term and Intermediate-Term Dermal and Inhalation Oxamyl Doses and Risk with Personal Protective Equipment and Engineering Controls.

Exposure Scenario	Crop or Target	Application Rate[a] (lb ai/A)	Area Treated Daily[b] (acres)	Unit Exposure[c, d]		Dermal Dose		MOEs	
				Dermal PPE-G (mg/lb ai)	Inhalation 80% PPE-R (µg/lb ai)	Dermal PPE-G[d] (mg/kg/day)	Inhalation 80% PPE-R respirator[e] (mg/kg/day)	Dermal PPE-G[f] (LOC = 100)	Inhalation 80% PPE-R respirator[g] (LOC = 30)
	Apples for Thinning (NJ, PA, VA, WV); Cotton (CA and AZ); Cucurbits; Eggplant (CA); Garlic (SLNWA); Nonbearing Fruit (apple, cherry, citrus, peach, pear); Peppers; Potatoes	1	350	0.023	0.24	0.12	0.0012	**150**	**330**
	Celery (AZ, CA); Cotton (not CA and AZ); Dry Bulb Onions (NM); Peanuts (not CA); Yams (Puerto Rico only)	0.5	350	0.023	0.24	0.058	0.0006	**300**	**650**
Mixing/Loading Liquid Concentrates for Groundboom Applications (PHED)	Nonbearing Fruit (apple, cherry, citrus, peach, pear; soil); Carrots (not CA); Celery (FL, PA, OH, MI, TX); Cucurbits (East of Rockies); Garlic (OR, SLN NY); Ginger Roots (HI); Dry Bulb Onions (MI, TX, OR, ID, WA, SLN NY, SLN WI); Sweet Potatoes (not in CA); Potatoes (U.S. except Northeast, Mid-Atlantic States)	4 (all soil-directed)	80	0.023	0.24	0.11	0.0011	**160**	**360**
	Pineapples (not CA); Eggplants (not CA); Garlic (CA); Dry Bulb Onions (CA); Peppermint and Spearmint (ID, MI, MT, OR, WA, WI); Potatoes (SLN MD, SLN NY, SLN PA); Tobacco; Sugar Beets	2	80	0.023	0.24	0.053	0.00055	**320**	**710**

Table 7. Occupational Short-Term and Intermediate-Term Dermal and Inhalation Oxamyl Doses and Risk with Personal Protective Equipment and Engineering Controls.

Exposure Scenario	Crop or Target	Application Rate[a] (lb ai/A)	Area Treated Daily[b] (acres)	Unit Exposure[c, d]		Dermal Dose		MOEs	
				Dermal PPE-G (mg/lb ai)	Inhalation 80% PPE-R (µg/lb ai)	Dermal PPE-G[d] (mg/kg/day)	Inhalation 80% PPE-R respirator[e] (mg/kg/day)	Dermal PPE-G[f] (LOC = 100)	Inhalation 80% PPE-R respirator[g] (LOC = 30)
Mixing/Loading Liquid Concentrates for Groundboom Applications (PHED) cont	Tomatoes (CA)	1.25	80	0.023	0.24	0.033	0.00034	**520**	**1,100**
	Clover Grown for Seed (SLN CA); Cucurbits (West of Rockies); Dry Bulb Onions (, SLN CO, SLN NV, SLN UT); Eggplants (CA); Garlic (SLNWA); Peppers; Potatoes (Northeast and Mid-Atlantic States); Tomatoes (entire US)	1	80	0.023	0.24	0.026	0.00027	**650**	**1,400**
	Cotton (AZ and CA)	1	200	0.023	0.24	0.066	0.00069	**260**	**570**
	Cotton (U.S. except CA and AZ)	0.5	200	0.023	0.24	0.033	0.00034	**520**	**1,100**
	Celery (AZ, CA); Dry Bulb Onions (NM); Yams (Puerto Rico Only); Peanuts (not in CA)	0.5	80	0.023	0.24	0.013	0.00014	**1,300**	**2,800**
Mixing/Loading Liquid Concentrates for Airblast Applications (PHED)	Apples; Pears (not CA)	2	40	0.023	0.24	0.026	0.00027	**650**	**1,400**
	Apples for Thinning (NJ, PA, VA, WV); Citrus; Nonbearing Fruit (apple, cherry, citrus, peach, pear)	1	40	0.023	0.24	0.013	0.00014	**1,300**	**2,800**
Applicator									

Table 7. Occupational Short-Term and Intermediate-Term Dermal and Inhalation Oxamyl Doses and Risk with Personal Protective Equipment and Engineering Controls.

Exposure Scenario	Crop or Target	Application Rate[a] (lb ai/A)	Area Treated Daily[b] (acres)	Unit Exposure[c, d]		Dermal Dose		MOEs	
				Dermal PPE-G (mg/lb ai)	Inhalation 80% PPE-R (µg/lb ai)	Dermal PPE-G[d] (mg/kg/day)	Inhalation 80% PPE-R respirator[e] (mg/kg/day)	Dermal PPE-G[f] (LOC = 100)	Inhalation 80% PPE-R respirator[g] (LOC = 30)
Applying Sprays via Aerial Equipment (PHED)[d]	Apples (WA only); Citrus; Clover Grown for Seed (SLN CA); Cucurbits (East of Rockies), Garlic (OR & CA - Modoc & Siskiyou counties, SLN NY); Nonbearing Fruit (apple, cherry, citrus, peach, pear); Dry Bulb Onions (CA - Modoc & Siskiyou counties, OR, ID, WA, SLN CO, SLN NV, SLN NY, SLN UT, SLN WI); Peppermint and Spearmint (ID, MI, MT, OR, WA, WI); Peppers; Potatoes (also SLN PA); Tomatoes	1	350	0.005 (w/ EC)	0.068 (w/ EC)	0.025 (w/ EC)	0.00034 (w/ EC)	**680** (w/ EC)	**1,100** (w/ EC)
	Cotton (CA and AZ)	1	1200	0.005 (w/ EC)	0.068 (w/ EC)	0.086 (w/ EC)	0.0012 (w/ EC)	**200** (w/ EC)	**330** (w/ EC)
	Cotton (not AZ and CA)	0.5	1200	0.005 (w/ EC)	0.068 (w/ EC)	0.043 (w/ EC)	0.00058 (w/ EC)	**400** (w/ EC)	**670** (w/ EC)
	Celery (AZ, CA, FL); Dry Bulb Onions (MI, NM, TX); Peanuts (not CA)	0.5	350	0.005 (w/ EC)	0.068 (w/ EC)	0.013 (w/ EC)	0.00017 (w/ EC)	**1,400** (w/ EC)	**2,300** (w/ EC)
Applying Sprays via Groundboom Equipment (PHED)	Nonbearing Fruit (apple, cherry, citrus, peach, pear); Carrot (not CA); Celery (FL, PA, OH, MI, TX); Cucurbits (East of Rockies); Garlic (OR, SLN NY); Ginger Root (HI); Dry Bulb Onions (MI, TX, OR, ID, WA, SLN NY, SLN WI); Sweet Potatoes (not in CA); Potatoes (U.S. except Northeast, Mid-Atlantic States)	4 (all soil-directed)	80	0.014	0.148	0.064	0.00068	**270**	**580**
	Pineapple (not CA); Eggplant (not CA); Garlic (CA); Dry Bulb Onions (CA); Peppermint and Spearmint (ID, MI, MT, OR, WA, WI); Potatoes (SLN MD, SLN NY, SLN PA); Tobacco; Sugar Beet	2	80	0.014	0.148	0.032	0.00034	**530**	**1,200**
	Tomatoes (CA)	1.25	80	0.014	0.148	0.02	0.00021	**850**	**1,800**

Table 7. Occupational Short-Term and Intermediate-Term Dermal and Inhalation Oxamyl Doses and Risk with Personal Protective Equipment and Engineering Controls.

Exposure Scenario	Crop or Target	Application Rate[a] (lb ai/A)	Area Treated Daily[b] (acres)	Unit Exposure[c, d]		Dermal Dose		MOEs	
				Dermal PPE-G (mg/lb ai)	Inhalation 80% PPE-R (µg/lb ai)	Dermal PPE-G[d] (mg/kg/day)	Inhalation 80% PPE-R respirator[e] (mg/kg/day)	Dermal PPE-G[f] (LOC = 100)	Inhalation 80% PPE-R respirator[g] (LOC = 30)
Applying Sprays via Groundboom Equipment (PHED) cont.	Clover Grown for Seed (SLN CA); Cucurbits (West of Rockies); Dry Bulb Onions (SLN CO, SLN NV, SLN U T); Eggplant (CA); Garlic (SLNWA); Peppers; Potatoes (Northeast and Mid-Atlantic States); Tomatoes (entire US)	1	80	0.014	0.148	0.016	0.00017	**1,100**	**2,300**
	Cotton (AZ and CA)	1	200	0.014	0.148	0.04	0.00042	**430**	**920**
	Cotton (U.S. except CA and AZ)	0.5	200	0.014	0.148	0.02	0.00021	**850**	**1,800**
	Celery (AZ, CA); Dry Bulb Onions (NM); Yams (Puerto Rico Only); Peanuts (not in CA)	0.5	80	0.014	0.148	0.008	0.000085	**2,100**	**4,600**
Applying Sprays via Airblast Equipment (PHED)	Apples; Pears (not CA)	2	40	0.24 (0.22 for PPE-G, DL, 0.17 for PPE-G,DL, HG & 0.019 for EC)	0.9	0.27 (0.25 for PPE-G, DL, 0.19 for PPE-G,DL, HG & 0.022 for EC)	0.001	62 (68 for PPE-G, DL, 88 for PPE-G,DL, HG & **790 for EC**)	**380**
	Apples for Thinning (NJ, PA, VA, WV); Citrus; Nonbearing Fruit (apple, cherry, citrus, peach, pear)	1	40	0.24	0.9	0.14	0.00051	**120**	**760**

Table 7. Occupational Short-Term and Intermediate-Term Dermal and Inhalation Oxamyl Doses and Risk with Personal Protective Equipment and Engineering Controls.

Exposure Scenario	Crop or Target	Application Rate[a] (lb ai/A)	Area Treated Daily[b] (acres)	Unit Exposure[c, d]		Dermal Dose		MOEs	
				Dermal PPE-G (mg/lb ai)	Inhalation 80% PPE-R (µg/lb ai)	Dermal PPE-G[d] (mg/kg/day)	Inhalation 80% PPE-R respirator[e] (mg/kg/day)	Dermal PPE-G[f] (LOC = 100)	Inhalation 80% PPE-R respirator[g] (LOC = 30)
Flagger									
Flagging for Aerial Sprays Applications (PHED)	Apples (WA only); Citrus; Clover Grown for Seed (SLN CA); Cucurbits (East of Rockies), Garlic (OR & CA - Modoc & Siskiyou counties, SLN NY); Nonbearing Fruit (apple, cherry, citrus, peach, pear); Dry Bulb Onions (CA - Modoc & Siskiyou counties, OR, ID, WA, SLN CO, SLN NV, SLN NY, SLN UT, SLN WI); Peppermint and Spearmint (ID, MI, MT, OR, WA, WI); Peppers; Potatoes (also SLN PA); Tomatoes	1	350	Not applicable	0.07	Not applicable	0.00035	Not applicable	**1,100**
	Cotton (CA and AZ)	1	350	Not applicable	0.07	Not applicable	0.00035	Not applicable	**1,100**
	Cotton (U.S. except AZ and CA)	0.5	350	Not applicable	0.07	Not applicable	0.00018	Not applicable	**2,200**
	Celery (AZ, CA, FL); Dry Bulb Onions (MI, NM, TX); Peanuts (not CA)	0.5	350	Not applicable	0.07	Not applicable	0.00018	Not applicable	**2,200**
Mixer/Loader/Applicator									
Mixing/Loading/Applying Liquid Concentrates with Low Pressure Handwand (PHED)	Bananas, Plantains (PR)	3.6	2	0.43	6	0.044	0.00061	**390**	**640**
Mixing/Loading/Applying Liquid Concentrates with Low Pressure Handwand (ORETF, ground directed)	Bananas, Plantains (PR)	3.6	2	0.33	0.54	0.034	0.000055	**510**	**7,100**

Table 7. Occupational Short-Term and Intermediate-Term Dermal and Inhalation Oxamyl Doses and Risk with Personal Protective Equipment and Engineering Controls.

Exposure Scenario	Crop or Target	Application Rate[a] (lb ai/A)	Area Treated Daily[b] (acres)	Unit Exposure[c, d]		Dermal Dose		MOEs	
				Dermal PPE-G (mg/lb ai)	Inhalation 80% PPE-R (µg/lb ai)	Dermal PPE-G[d] (mg/kg/day)	Inhalation 80% PPE-R respirator[e] (mg/kg/day)	Dermal PPE-G[f] (LOC = 100)	Inhalation 80% PPE-R respirator[g] (LOC = 30)
Mixing/Loading/Applying Liquid Concentrates with a Handgun Sprayer (LCO ORETF data)	Nonbearing Fruit (apple, cherry, citrus, peach, pear)	4	5	0.45	0.36	0.13	0.0001	**130**	**3,800**
	Apples; Pears (not CA)	2	5	0.45	0.36	0.064	0.000051	**270**	**7,600**
Mixing/Loading/Applying Liquid Concentrates with a Handgun Sprayer (LCO ORETF data) cont	Apples for Thinning (NJ, PA, VA, WV); Citrus	1	5	0.45	0.36	0.032	0.000026	**530**	**15,000**

Footnotes

a. Application rates are maximum application rates from the labels.
b. Science Advisory Council Policy # 9.1
c. Unit Exposures based on PHED Version 1.1 and ORETF.
Baseline dermal unit exposure represents long pants, long sleeved shirt, no gloves, open mixing/loading, open cab tractor.
Baseline inhalation exposure represents no respirator.
PPE – G = Baseline attire (single layer of clothing) plus chemical-resistant gloves.
PPE – G, DL = Coveralls worn over long-sleeve shirt and long pants, plus chemical-resistant gloves. An HG indicates that head gear is also worn.
PPE – R 80% = A quarter-face dust/mist respirator (that provides an 80% protection factor).
EC = Engineering Control = closed systems for mixing/loading liquids, enclosed cockpits for aerial application, and enclosed cabs for airblast application.
d. Only engineering control (enclosed cockpit) data are available to assess dermal and inhalation risks to handlers operating aircraft.
e. Dermal Dose (mg/kg/day) = daily unit exposure (mg/lb ai) x application rate (lb ai/acre) x acres treated / body weight (70 kg).
f. Inhalation Dose (mg/kg/day) = daily unit exposure (µg/lb ai) x conversion factor (1 mg/1,000 µg) x application rate (lb ai/acre) x acres treated / body weight (70 kg).
g. Dermal MOE = NOAEL (17.05 mg/kg/day) / dermal daily dose (mg/kg/day). Level of concern = 100.
h. Inhalation MOE = NOAEL (0.39 mg/kg/day) / inhalation daily dose (mg/kg/day). Level of concern = 30.

4.2 Postapplication Exposures

4.2.1 Postapplication Assumptions and Calculations

Inhalation: HED assumes that inhalation exposures are minimal following outdoor applications of an active ingredient with low vapor pressure.

Dermal: The registrant has submitted three dislodgeable foliar residue (DFR) studies in support of the reregistration of oxamyl:

- "Dissipation of Dislodgeable Foliar and Soil Residues of Oxamyl Following Application of Vydate® L Insecticide to Tomatoes in the USA- Season 1997 and 1998;" MRID 447048-01.

- "Dissipation of Dislodgeable Foliar Residues of Oxamyl from Citrus Following Application of Vydate® L Insecticide in the U.S.A - Season 1997;" MRID 446869-01.

- "Dissipation of Dislodgeable Foliar Residues of Oxamyl from Cucumbers Following Application of Vydate® L Insecticide in the U.S.A. - Season 1997;" MRID 446869-02.

The dissipation data obtained from these studies has been used to determine the days after treatment when the calculated MOE did not exceed HED's level of concern (MOE $\geq$ 100) for oxamyl crops following foliar applications of oxamyl. The raw data from the studies are corrected for recoveries as appropriate. The data is then natural log transformed. A semi-log regression analysis is run on the log transformed data. From the regression analysis, a dissipation rate (slope) and predicted dislodgeable foliar residue data for each site and crop is determined. If the day 0 actual DFR data are significantly higher than the predicted DFR, then the actual data are used for day 0 calculations. The following calculations are used to calculate the dose and risk. The Restricted Entry Interval (REI) typically is established on the day that the calculated MOE is 100 or above.

Daily dose is calculated as follows:

$$Dose\ (mg/kg/d) = \frac{(DFR\ (\mu g/cm^2)\ x\ Tc\ (cm^2/hr)\ x\ CF\left(\frac{1\ mg}{1{,}000\ \mu g}\right)\ x\ ED\ (hrs)}{BW\ (kg)}$$

Where:

DFR = Dislodgeable Foliar Residue initial or daily ($\mu g/cm^2$) at time (t).
Tc = Transfer coefficient (cm^2/hr)

CF = Conversion factor (1 mg/1,000 μg)
ED = Exposure duration (hours per day)
BW = Body weight (kg)

The daily MOE is calculated as follows:

$$MOE = \frac{NOAEL\ (mg/kg/day)}{Dose\ (mg/kg/day)}$$

Where:
NOAEL = 17.05 mg/kg/day
Dose = Calculated dose

The following general assumptions are made:

- Only crops where oxamyl is applied to the foliage are included in this assessment. There are no soil transfer values available to evaluate postapplication exposure and risk following oxamyl applications to the soil. However, the exposure is likely to be minimal and the default REI for oxamyl should be sufficiently protective for postapplication workers exposed to oxamyl in the soil.

- The transfer coefficients used in this assessment are from the Agricultural Reentry Task Force (ARTF) database. An interim transfer coefficient policy was developed by HED's Science Advisory Council for Exposure using the ARTF database (policy # 3.1). It is the intention of HED's Science Advisory Council for Exposure that this policy will be periodically updated to incorporate additional information about agricultural practices in crops and new data on transfer coefficients.

- A route-specific dermal study was used to select an endpoint, so a dermal absorption value is not necessary.

- The exposure duration is assumed to be 8 hour work day.

- Adult body weight is 70 kg.

Table 8 is a summary of the DFR studies' parameters. A detailed summary of each DFR is below.

Table 8. Comparison of Dislodgeable Foliar Residue Study Parameters						
Crop	**Tomatoes**		**Citrus**		**Cucumbers**	
Site	**Florida**	**California**	**Florida**	**California**	**Georgia**	**California**
Slope	-0.43	-0.12	-0.235	-0.078	-0.51	-0.282
Initial Residues ($\mu g/cm^2$)	1.85	3.83 (actual)	2.14 (actual)	2.05 (actual)	4.1 (actual)	3.9 (actual)
Study Application Rate (lb ai/A)	1		1		1	
Half Life (days)	1.6	5.8	3.0	8.9	1.4	2.5
R^2 Values	0.99	0.67	0.86	0.76	0.81	0.94

Cucumber DFR Study - MRID 446869-02: The study: "Dissipation of Dislodgeable Foliar Residues of Oxamyl from Cucumbers Following Application of Vydate® L Insecticide in the U.S.A. - Season 1997;" (MRID 446869-02), was submitted by the registrant and reviewed by HED. The study was conducted at two sites, one in California and one in Georgia, during the summer of 1997. The treated plot at each site received two applications of Vydate® L insecticide/ nematicide using a tractor-mounted boom sprayer. There was a fourteen-day interval between the applications. The application rate for each treatment was 1 pound of active ingredient (ai) per acre applied at a rate of 50 gallons per acre of finished spray at both sites. The data from leaf punches after the second treatment were used to characterize concentration of oxamyl on the treated crop and the rate of dissipation.

The subplots at the California site were furrow /flood irrigated, while the subplots at the Georgia site did not require irrigation. The rainfall for the month of July was 10.64 inches at the Georgia site. This exceeded the 10-year average for July at the Georgia site of 6.58 inches. However, the total average rainfall during the course of the study at the Georgia site was 12.55 inches. This was lower than the 10-year total average for the same stretch of time, which was 14.97 inches. The first rainfall after the last application at the Georgia site occurred on Day 4. At the California site, there was no rain during the course of the study and the irrigation water did not wet the sampled foliage.

Foliage leaf punch samples were collected randomly from dry viable leaves from each subplot and control plot using a one inch diameter Birkestrand® leaf punch sampler. One control sample from the control plot and three replicate samples from the treated plot were collected at both study sites at the following sampling intervals: prior to each application, immediately after each application after the spray dried (day 0), and 1, 2, 3, 7, 14 ,21, 28, and 35 days after the second (final) application. The California site experienced an insect infestation after the 28th day, leaving no viable leaves to be sampled on the 35th day.

For the Georgia and California sites, on day 0 the actual DFR data are higher than the predicted DFR data. Since using the predicted values for day 0 would underestimate exposure, the actual values are also reported for day 0 for this site. Results from the regression analysis are presented in Table 9 of this report.

Table 9. Cucumber Foliar Dissipation for Oxamyl (MRID 446869-02)

Site	DFR (μg/cm²) Predicted Values–Based on Log Transformed Data (Values in Parentheses are Actual Field Measured Averages)									
	0 DAT	1 DAT	2 DAT	3 DAT	4 DAT	5 DAT	6 DAT	7 DAT	R^2	Slope ($t_{½}$ days)[a]
Georgia	1 (4.1)	0.6 (0.87)	0.36	0.22	0.13	0.079	0.048	0.029	0.81	-0.508 (1.36)
California	3.2 (3.9)	2.4 (3.4)	1.8 (2.8)	1.4	1.03	0.78	0.59	0.44	0.94	-0.282 (2.46)

a $t_{½}$ is the calculated half-life of oxamyl at the Georgia site are from 0 DAT to 14 DAT and the half-life of oxamyl at the California site are from 0 DAT to 28 DAT.

Tomato DFR Study - MRID 447048-01: The study: *"Dissipation of Dislodgeable Foliar and Soil Residues of Oxamyl Following Application of Vydate® L Insecticide to Tomatoes in the USA- Season 1997 and 1998."* (MRID 447048-01) was submitted by the registrant and reviewed by HED. There were two sites in the study, one in California and one in Florida. Two applications of Vydate®L were applied 5 days apart to test fields. For the California site, the applications were made beginning in mid July 1997 and for the Florida site, the applications were made in mid November 1997. Vydate®L was applied twice at each site using a broadcast boom sprayer at an application rate of 1.0 lb ai per acre in 50 gallons per acre of final volume. The data from leaf punches after the second treatment were used to characterize concentration of oxamyl on the treated crop and the rate of dissipation. Numerous rainfall events occurred during the study at the Florida site. During the study from Nov. 13, 1997 - Dec. 23, 1997, 14.40 inches of precipitation fell at the Florida site, while the 10-year average precipitation amounts were 2.36 inches in Nov. and 2.82 inches in December. The first rainfall after the last application at the Florida site occurred on Day 16. Only one rain event occurred at the California site - 0.05 inches on Day 2 after the last application.

The average foliar residues immediately after the second (last) application were 2.03 μg/cm² at the Florida site and 3.83 μg/cm² at the California site. After 14 days, the residues declined to 0.005 μg/cm² at the Florida site and 0.065 μg/cm² at the California site. At the Florida site, the DFR residues were less than the limit of quantitation (LOQ) of 0.001 μg/cm² after Day 14; therefore, data on Day 21, 28, and 35 were removed from regression analysis for this site. Results from the regression analysis are presented in Table 10 of this report.

Table 10. Tomato Foliar Dissipation for Oxamyl (MRID 447048-01)										
Site	DFR (µg/cm^2) Predicted Values – Based on Log Transformed Data (Values in Parentheses are Actual Field Measured Averages)									
	0 DAT	1 DAT	2 DAT	3 DAT	4 DAT	5 DAT	6 DAT	7 DAT	R^2	Slope ($t_{½}$ days)[a]
Florida	1.85	1.21	0.79	0.51	0.34	0.22	0.14	0.094	0.99	-0.425 (1.62)
California (foliar)	0.61 (3.83)	0.54 (1.29)	0.48	0.43	0.38	0.34	0.30	0.27	0.24	-0.119 (5.84)

a $t_{½}$ is the calculated half-life of oxamyl at the Florida site are from 0 DAT to 14 DAT and the half-life of Oxamyl at the California site are from 0 DAT to 35 DAT.

Citrus DFR Study - MRID 446869-01: The study: *"Dissipation of Dislodgeable Foliar Residues of Oxamyl from Citrus Following Application of Vydate® L Insecticide in the U.S.A - Season 1997"* (MRID 446869-01) was submitted by the registrant and review by HED. The study was done at two sites, one in Florida and one in California. The treated plots at each site received two applications of Vydate® L insecticide using airblast sprayer applications of the test substance. At the California site, each application was 1.0 pounds of active ingredient per acre in 100 gallons of finished spray per acre. The data from leaf punches after the second treatment were used to characterize concentration of oxamyl on the treated crop and the rate of dissipation. A protocol deviation occurred when for the first application in Florida; Vydate®L was sprayed 1.25 lb ai/acre due to an increase in spray pressure from 60 to 100 PSI in 147 gallons per acre. Insertion of a pressure regulator for the second application brought the application rate down to 1.0 lb ai/acre in 101 gallons of finished spray per acre. The sprayers were calibrated prior to all applications by the volume/time method. In California, irrigation occurred four times with a microsprinkler irrigation that did not wet the foliage sampled. The California site had 1.3 inches of rainfall during the course of the study – the ten year average is 1.46 inches. In Florida, the rainfall per day ranged from 0.2 to 2.6 inches. The total rainfall during the sampling period was 13.7 inches – the ten year average is 20 inches.

For the Florida and California sites, on day 0 the actual DFR data are higher than the predicted DFR data. Since using the predicted values for day 0 would underestimate exposure, the actual values are also reported for day 0 for this site. Results from the regression analysis are presented in Table 11 of this report.

Table 11. Citrus Foliar Dissipation for Oxamyl (MRID 446869-01)										
Site	DFR (µg/cm^2) Predicted Values – Based on Log Transformed Data (Values in Parentheses are Actual Field Measured Averages)									
	.0 DAT	1 DAT	2 DAT	3 DAT	4 DAT	5 DAT	6 DAT	7 DAT	R^2	Slope ($t_{½}$ days)[a]
Florida	0.639 (2.14)	0.505 (1.46)	0.40 (0.477)	0.316	0.250	0.198	0.156	0.124	0.858	-0.235 (2.95)
California	0.738 (2.05)	0.683	0.632	0.585	0.541	0.501	0.463	0.429	0.76	0.078 (8.92)

a $t_{½}$ is the calculated half-life of oxamyl at the Florida and California site are from 0 DAT to 35 DAT.

Use of the Oxamyl DFR Study Data

The citrus DFR study data was used to assess exposure to oxamyl-treated foliage for citrus and also was used to assess exposure to foliage from the other tree crops (pears, apples, bananas, plantains, and non-bearing trees). The cucumber DFR study data was used to assess exposure to oxamyl-treated foliage for the cucurbit crops. And the tomato DFR study data were used to assess exposure to oxamyl-treated foliage for tomatoes and other fruiting vegetables (peppers and eggplant). For all the remaining crops, both the tomato residue data (MRID 44704801) *and* the cucumber residue data (MRID 44686902) were used to assess exposure to oxamyl-treated foliage. For all crops where both tomato and cucumber residue data are presented, the results for the California sites were averaged and the results from the Florida and Georgia sites were averaged. The DFR values from the three submitted studies were adjusted proportionately to reflect remaining crops application rates. The new DFR values are calculated as follows:

$$Adjusted\ DFR\ (\mu g/cm^2) = \frac{Study\ DFR\ (\mu g/cm^2)\ x\ crop\ application\ rate\ (lbsai/A)}{study\ application\ rate\ (lbsai/A)}$$

4.2.2 Summary of Risk Concerns for Postapplication Workers

See Tables 12 and 13 for a summary of the postapplication results. The resulting postapplication assessments indicate that the MOEs equal or exceed 100 on the day specified for the following crops, according to the DFR study site and tasks that represent the highest transfer coefficient. The postapplication risk assessment indicates that for many crops, risks remain a concern for several days following application.

Table 12: Oxamyl Postapplication Risks for Tree Crops

Crop	Appl. Rate[a] (lbs. ai/ acre)	Transfer Coefficient[b] (cm^2/hr) and Activity	DFR Data Source[c]	Dose at Day 0[d] (mg/kg/day)	MOE at Day 0[e]	Day After Treatment When MOE ≥100[f]
Banana/ Plantain	3.6	2000 Training, Hand Pruning, Thinning, Topping, Hand Weeding	Florida	1.80	10	5
			California	1.70	10	17
Apples	2	3000 Hand Harvesting, Thinning, Propping, Training, Hand Pruning	Florida	1.50	12	5
			California	1.40	12	14

Table 12: Oxamyl Postapplication Risks for Tree Crops

Crop	Appl. Rate[a] (lbs. ai/ acre)	Transfer Coefficient[b] (cm^2/hr) and Activity	DFR Data Source[c]	Dose at Day 0[d] (mg/kg/day)	MOE at Day 0[e]	Day After Treatment When MOE ≥100[f]
Citrus	2	3000 Hand Harvesting, Hand Pruning, Thinning	Florida	1.50	12	5
			California	1.40	12	14
Pears (U.S., except CA)	2	3000 Hand Harvesting, Thinning, Tying, Hand Pruning, Training	Florida	1.50	12	5
			California	1.40	12	14
Nonbearing Fruit Trees	1	400 All Tasks	Florida	0.098	170	0 (12 hours)
			California	0.094	180	0 (12 hours)

a. Application rates are the maximum application rates determined from EPA registered labels for oxamyl.
b. Transfer Coefficients are from Science Advisory Council on Exposure Policy 3.1. Risks were only assessed for the highest transfer coefficient available for a crop.
c. The results from the analysis using actual DFR values for Day 0. The actual DFR values were used instead of the predicted DFRs when the actual DFR values were higher than the predicted DFR values.
DFR Data sources:
Citrus CA: MRID 44686901: Slope = -0.078, Day 0 (actual) = 2.05, Study Application Rate = 1
Citrus FL: MRID 44686901: Slope = -0.235, Day 0 (actual) = 2.14, Study Application Rate = 1
d. Daily Dose = [DFR ($\mu g/cm^2$) x Transfer Coefficient (cm^2/hr) x 0.001 mg/µg x 8 hrs/day] ÷ body weight (70 kg adult)
e. MOE = NOAEL/Daily Dose (Adult Dermal NOAEL = 17.05 mg/kg/day). Target MOE = 100
f. Day After Treatment When MOE ≥100. Values in **bold** indicate that the calculated REI is greater than 48 hrs.

Table 13: Oxamyl Postapplication Risks for Vegetable and Non-tree Fruit Crops

Crop	Appl. Rate[a] (lbs. ai/ acre)	Transfer Coefficient[b] (cm^2/hr) And Activity	DFR Data Source[c]	Dose at Day 0[d] (mg/kg/day)	MOE at Day 0[e]	Day After Treatment When MOE ≥100[f]	Average Day after Treatment when MOE ≥100
Celery (FL, PA, OH, MI, TX)	2	2500 Hand harvesting	Cucumber GA	2.3	7	3	4
			Tomato FL	1.1	16	5	
			Cucumber CA	2.2	8	9	8
			Tomato CA	2.0	9	7	

Table 13: Oxamyl Postapplication Risks for Vegetable and Non-tree Fruit Crops

Crop	Appl. Rate[a] (lbs. ai/ acre)	Transfer Coefficient[b] (cm^2/hr) And Activity	DFR Data Source[c]	Dose at Day 0[d] (mg/kg/day)	MOE at Day 0[e]	Day After Treatment When MOE ≥100[f]	Average Day after Treatment when MOE ≥100
Celery (AZ, CA)	0.5	2500 Hand harvesting	Cucumber GA	0.59	29	1	2
			Tomato FL	0.26	65	2	
			Cucumber CA	0.55	31	4	3
			Tomato CA	0.5	34	2	
Peppermint and Spearmint (ID, MI, MT, OR, WA, WI)	2	1500 Irrigation; scouting; hand weeding	Cucumber GA	1.4	12	2	3
			Tomato FL	0.63	27	4	
			Cucumber CA	1.3	13	7	5
			Tomato CA	1.2	14	2	
Pineapples	2	1000 Hand harvesting; hand pruning	Cucumber GA	0.94	18	2	2
			Tomato FL	0.21	81	1	
			Cucumber CA	0.88	19	6	4
			Tomato CA	0.81	21	2	
Garlic (OR, CA)	2	300 Irrigation; scouting; thinning; hand weeding	Cucumber GA	0.28	60	1	1
			Tomato FL	0.13	130	0 (12 hours)	
			Cucumber CA	0.28	60	3	2
			Tomato CA	0.24	70	1	
Garlic (SLN NY, SLN WA)	1	300 Irrigation; scouting; thinning; hand weeding	Cucumber GA	0.14	120	0 (12 hours)	0 (12 hours)
			Tomato FL	0.06	270	0 (12 hours)	
			Cucumber CA	0.13	130	0 (12 hours)	0 (12 hours)
			Tomato CA	0.12	140	0 (12 hours)	

Table 13: Oxamyl Postapplication Risks for Vegetable and Non-tree Fruit Crops

Crop	Appl. Rate[a] (lbs. ai/ acre)	Transfer Coefficient[b] (cm^2/hr) And Activity	DFR Data Source[c]	Dose at Day 0[d] (mg/kg/day)	MOE at Day 0[e]	Day After Treatment When MOE ≥100[f]	Average Day after Treatment when MOE ≥100
Onions, Dry Bulb (OR, ID, WA, CA, MI, TX	2	300 Irrigation; scouting; thinning; hand weeding	Cucumber GA	0.28	60	1	1
			Tomato FL	0.13	130	0 (12 hours)	
			Cucumber CA	0.28	60	3	2
			Tomato CA	0.24	70	1	
Onions, Dry Bulb (SLN CO, SLN NV, SLN NY, SLN UT)	1	300 Irrigation; scouting; thinning; hand weeding	Cucumber GA	0.14	120	0 (12 hours)	0 (12 hours)
			Tomato FL	0.06	270	0 (12 hours)	
			Cucumber CA	0.13	130	0 (12 hours)	0 (12 hours)
			Tomato CA	0.12	140	0 (12 hours)	
Onions, Dry Bulb (NM, SLN WI)	0.5	300 Irrigation; scouting; thinning; hand weeding	Cucumber GA	0.07	240	0 (12 hours)	0 (12 hours)
			Tomato FL	0.03	540	0 (12 hours)	
			Cucumber CA	0.07	260	0 (12 hours)	0 (12 hours)
			Tomato CA	0.06	280	0 (12 hours)	
Clover Grown for Seed (SLN CA)	1.0	1500 Irrigation; scouting;	Cucumber GA	0.7	24	1	2
			Tomato FL	0.32	54	2	
			Cucumber CA	0.66	26	5	4
			Tomato CA	0.61	28	2	
Carrot	1	2500 Hand harvesting;	Cucumber GA	1.20	15	2	3
			Tomato FL	0.53	32	3	
			Cucumber CA	1.10	15	6	4
			Tomato CA	1.00	17	2	

Table 13: Oxamyl Postapplication Risks for Vegetable and Non-tree Fruit Crops

Crop	Appl. Rate[a] (lbs. ai/ acre)	Transfer Coefficient[b] (cm^2/hr) And Activity	DFR Data Source[c]	Dose at Day 0[d] (mg/kg/day)	MOE at Day 0[e]	Day After Treatment When MOE ≥100[f]	Average Day after Treatment when MOE ≥100
Cucurbits	1	2500 Hand harvesting; hand pruning, thinning	Cucumber GA	1.20	15	2	2
			Cucumber CA	1.10	15	6	6
Cotton (AZ and CA)	1	2500 Hand harvesting;	Cucumber GA	1.20	15	2	3
			Tomato FL	0.53	32	3	
			Cucumber CA	1.10	15	6	4
			Tomato CA	1.00	17	2	
Cotton (U.S. except AZ and CA);	0.5	2500 Hand harvesting	Cucumber GA	0.59	29	1	2
			Tomato FL	0.26	65	2	
			Cucumber CA	0.55	31	4	3
			Tomato CA	0.50	34	2	
Potatoes (SLN MD, SLN NY)	2	1500 Irrigation; scouting	Cucumber GA	1.4	12	2	3
			Tomato FL	0.63	27	4	
			Cucumber CA	1.3	13	7	5
			Tomato CA	1.2	14	2	
Sugar Beet (Entire U.S.); Potatoes (also SLN PA)	1	1500 Irrigation; scouting	Cucumber GA	0.7	24	1	2
			Tomato FL	0.32	54	2	
			Cucumber CA	0.66	26	5	4
			Tomato CA	0.61	28	2	

Table 13: Oxamyl Postapplication Risks for Vegetable and Non-tree Fruit Crops

Crop	Appl. Rate[a] (lbs. ai/ acre)	Transfer Coefficient[b] (cm^2/hr) And Activity	DFR Data Source[c]	Dose at Day 0[d] (mg/kg/day)	MOE at Day 0[e]	Day After Treatment When MOE ≥100[f]	Average Day after Treatment when MOE ≥100
Eggplant; Tomatoes; Peppers	1	1000 Hand harvesting; hand pruning (eggplant and tomato); staking; tying, thinning (tomato); training (tomato)	Tomato FL	0.21	81	1	1
			Tomato CA	0.4	42	1	1
Ginger Root (HI)	1	300 Irrigation; scouting; thinning; hand weeding	Cucumber GA	0.14	120	0 (12 hours)	0 (12 hours)
			Tomato FL	0.06	270	0 (12 hours)	
			Cucumber CA	0.13	130	0 (12 hours)	0 (12 hours)
			Tomato CA	0.12	140	0 (12 hours)	
Peanuts (U.S. except CA)	0.5	.1500 Irrigation; scouting	Cucumber GA	0.35	48	1	1
			Tomato FL	0.16	110	0 (12 hours)	
			Cucumber CA	0.33	52	3	2
			Tomato CA	0.3	56	1	

a. Application rates are the maximum application rates determined from EPA registered labels for oxamyl.
b. Transfer Coefficients are from Science Advisory Council on Exposure Policy 3.1. Risks were only assessed for the highest transfer coefficient available for a crop.
c. The results from the analysis using actual DFR values for Day 0 for cucumber GA, cucumber CA, and tomato CA. The actual DFR values were used instead of the predicted DFRs when the actual DFR values were significantly higher than the predicted DFR values. An analysis using actual DFR values was not necessary for the tomato data from Florida.
DFR Data sources:
Cucumber CA: MRID 44686902: Study Application Rate = 1, Slope = -0.282, Day 0 (predicted) = 3.2 $\mu g/cm^2$, Day 0 (actual) = 3.86 $\mu g/cm^2$, Day 1 (actual) = 3.42 $\mu g/cm^2$, Day 2 (actual) = 2.83 $\mu g/cm^2$, Day 3 (predicted) = 1.37 $\mu g/cm^2$, Day 4 (predicted) = 1.03 $\mu g/cm^2$), Day 5 (predicted) = 0.778 $\mu g/cm^2$.
Tomato CA: MRID 44704801: Study Application Rate = 1, Slope = -0.119, Day 0 (predicted) = 0.61 $\mu g/cm^2$, Day 0 (actual) = 3.83 $\mu g/cm^2$, Day 1 (actual) = 1.29 $\mu g/cm^2$, Day 2 (predicted) = 0.48 $\mu g/cm^2$, Day 3 (predicted) = 0.43 $\mu g/cm^2$, Day 4 (predicted) = 0.38 $\mu g/cm^2$, Day 5 (predicted) = 0.34 $\mu g/cm^2$,Day 6 (predicted) = 0.30 $\mu g/cm^2$
Cucumber GA: MRID 44686902
Study Application Rate = 1 lb ai/A, Slope (predicted) = -0.508, Day 0 (predicted) = 1, Day 0 (actual) = 4.11 $\mu g/cm^2$, Day 1 (actual) = 0.869 $\mu g/cm^2$, Day 2 (predicted) = 0.36 $\mu g/cm^2$, Day 3 (predicted) = 0.21 $\mu g/cm^2$.
Tomato FL: MRID 44704801: Study Application Rate = 1, Slope = -0.425, Day 0 (predicted) = 1.85
d. Daily Dose = [DFR ($\mu g/cm^2$) x Transfer Coefficient (cm^2/hr) x 0.001 mg/μg x 8 hrs/day] ÷ body weight (70 kg adult)
e. MOE = NOAEL/Daily Dose (Adult Dermal NOAEL = 17.05 mg/kg/day). Target MOE = 100
f. Day After Treatment When MOE ≥100. Values in **bold** indicate that the calculated REI is greater than 48 hrs.

5.0 RESIDENTIAL (NON-OCCUPATIONAL) EXPOSURE/RISK PATHWAY

This document presents the assessment of proposed agricultural uses of oxamyl. No residential uses are being requested at this time; therefore, no residential handler exposure and risk assessment has been conducted in this document.

Spray drift is always a potential source of exposure to residents nearby to spraying operations. This is particularly the case with aerial application, but, to a lesser extent, could also be a potential source of exposure from the airblast and groundboom application method additionally employed for oxamyl. The Agency has been working with the Spray Drift Task Force, EPA Regional Offices and State Lead Agencies for pesticide regulation and other parties to develop the best spray drift management practices. The Agency is now requiring interim mitigation measures for aerial applications that must be placed on product labels/labeling. The Agency has completed its evaluation of the new database submitted by the Spray Drift Task Force, a membership of U.S. pesticide registrants, and is developing a policy on how to appropriately apply the data and the AgDRIFT computer model to its risk assessments for pesticides applied by air, orchard airblast and ground hydraulic methods. After the policy is in place, the Agency may impose further refinements in spray drift management practices to reduce off-target drift and risks associated with aerial as well as other application types where appropriate.

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